Basic Trigonometric Function Formulas

There are basically 6 ratios used for finding the elements in Trigonometry. They are called trigonometric functions. The six trigonometric functions are sine, cosine, secant, co-secant, tangent and co-tangent.

By using a right-angled triangle as a reference, the trigonometric functions or identities are derived:

- sin θ = Opposite Side/Hypotenuse
- cos θ = Adjacent Side/Hypotenuse
- tan θ = Opposite Side/Adjacent Side
- sec θ = Hypotenuse/Adjacent Side
- cosec θ = Hypotenuse/Opposite Side
- cot θ = Adjacent Side/Opposite Side

Reciprocal Identities

The **Reciprocal Identities** are given as:

- cosec θ = 1/sin θ
- sec θ = 1/cos θ
- cot θ = 1/tan θ
- sin θ = 1/cosec θ
- cos θ = 1/sec θ
- tan θ = 1/cot θ

All these are taken from a right angled triangle. With the height and base side of the right triangle given, we can find out the sine, cosine, tangent, secant, cosecant, and cotangent values using trigonometric formulas. The reciprocal trigonometric identities are also derived by using the trigonometric functions.

Trigonometry Table

Below is the table for trigonometry formulas for angles that are commonly used for solving problems.

Angles (In Degrees)	0°	30°	45°	60°	90°	180°	270°	360°
Angles (In Radians)	0°	π/6	π/4	π/3	π/2	π	3π/2	2π
sin	0	1/2	1/√2	√3/2	1	0	-1	0
cos	1	√3/2	1/√2	1/2	0	-1	0	1
tan	0	1/√3	1	√3	∞	0	∞	0
cot	∞	√3	1	1/√3	0	∞	0	∞
csc	∞	2	√2	2/√3	1	∞	-1	∞
sec	1	2/√3	√2	2	∞	-1	∞	1

Periodicity Identities (in Radians)

These formulas are used to shift the angles by π/2, π, 2π, etc. They are also called co-function identities.

- sin (π/2 − A) = cos A & cos (π/2 − A) = sin A
- sin (π/2 + A) = cos A & cos (π/2 + A) = − sin A
- sin (3π/2 − A) = − cos A & cos (3π/2 − A) = − sin A
- sin (3π/2 + A) = − cos A & cos (3π/2 + A) = sin A
- sin (π − A) = sin A & cos (π − A) = − cos A
- sin (π + A) = − sin A & cos (π + A) = − cos A

- sin (2π – A) = – sin A & cos (2π – A) = cos A

- sin (2π + A) = sin A & cos (2π + A) = cos A

All trigonometric identities are cyclic in nature. They repeat themselves after this periodicity constant. This periodicity constant is different for different trigonometric identities. tan 45° = tan 225° but this is true for cos 45° and cos 225°. Refer to the above trigonometry table to verify the values.

Co-function Identities (in Degrees)

The co-function or periodic identities can also be represented in degrees as:

- sin(90°−x) = cos x

- cos(90°−x) = sin x

- tan(90°−x) = cot x

- cot(90°−x) = tan x

- sec(90°−x) = csc x

- csc(90°−x) = sec x

Sum & Difference Identities

- sin(x+y) = sin(x)cos(y)+cos(x)sin(y)

- cos(x+y) = cos(x)cos(y)–sin(x)sin(y)

- tan(x+y) = (tan x + tan y)/ (1−tan x •tan y)

- sin(x–y) = sin(x)cos(y)–cos(x)sin(y)

- cos(x–y) = cos(x)cos(y) + sin(x)sin(y)

- tan(x−y) = (tan x–tan y)/ (1+tan x • tan y)

Double Angle Identities

- $\sin(2x) = 2\sin(x) \cdot \cos(x) = [2\tan x/(1+\tan^2 x)]$

- $\cos(2x) = \cos^2(x)–\sin^2(x) = [(1-\tan^2 x)/(1+\tan^2 x)]$

- $\cos(2x) = 2\cos^2(x)−1 = 1–2\sin^2(x)$

- $\tan(2x) = [2\tan(x)]/ [1−\tan^2(x)]$

- $\sec(2x) = \sec^2 x/(2-\sec^2 x)$

- csc (2x) = (sec x. csc x)/2

Triple Angle Identities

- $\text{Sin } 3x = 3\sin x – 4\sin^3 x$

- $\text{Cos } 3x = 4\cos^3 x-3\cos x$

- $\text{Tan } 3x = [3\tan x-\tan^3 x]/[1-3\tan^2 x]$

Half Angle Identities

- $\sin\frac{x}{2} = \pm\sqrt{\frac{1-\cos x}{2}}$
- $\cos\frac{x}{2} = \pm\sqrt{\frac{1+\cos x}{2}}$
- $\tan(\frac{x}{2}) = \sqrt{\frac{1-\cos(x)}{1+\cos(x)}}$

Also, $\tan(\frac{x}{2}) = \sqrt{\frac{1-\cos(x)}{1+\cos(x)}} = \sqrt{\frac{(1-\cos(x))(1-\cos(x))}{(1+\cos(x))(1-\cos(x))}} = \sqrt{\frac{(1-\cos(x))^2}{1-\cos^2(x)}} = \sqrt{\frac{(1-\cos(x))^2}{\sin^2(x)}} = \frac{1-\cos(x)}{\sin(x)}$ So, $\tan(\frac{x}{2}) = \frac{1-\cos(x)}{\sin(x)}$

Product identities

- $\sin x \cdot \cos y = \frac{\sin(x+y)+\sin(x-y)}{2}$

- $\cos x \cdot \cos y = \frac{\cos(x+y)+\cos(x-y)}{2}$

- $\sin x \cdot \sin y = \dfrac{\cos(x-y) - \cos(x+y)}{2}$

Sum to Product Identities

- $\sin x + \sin y = 2\sin\dfrac{x+y}{2}\cos\dfrac{x-y}{2}$
- $\sin x - \sin y = 2\cos\dfrac{x+y}{2}\sin\dfrac{x-y}{2}$
- $\cos x + \cos y = 2\cos\dfrac{x+y}{2}\cos\dfrac{x-y}{2}$
- $\cos x - \cos y = -2\sin\dfrac{x+y}{2}\sin\dfrac{x-y}{2}$

Inverse Trigonometry Formulas

- $\sin^{-1}(-x) = -\sin^{-1} x$
- $\cos^{-1}(-x) = \pi - \cos^{-1} x$
- $\tan^{-1}(-x) = -\tan^{-1} x$
- $\operatorname{cosec}^{-1}(-x) = -\operatorname{cosec}^{-1} x$
- $\sec^{-1}(-x) = \pi - \sec^{-1} x$
- $\cot^{-1}(-x) = \pi - \cot^{-1} x$

What is Sin 3x Formula?

Sin 3x is the sine of three times of an angle in a right-angled triangle, that is expressed as:

Sin 3x = 3sin x – 4sin³x

Trigonometry Formulas From Class 10 to Class 12

Trigonometry Formulas For Class 12
Trigonometry Formulas For Class 11
Trigonometry Formulas For Class 10

Trigonometry Formulas Major systems

All trigonometric formulas are divided into two major systems:

- Trigonometric Identities
- Trigonometric Ratios

Trigonometric Identities are formulas that involve Trigonometric functions. These identities are true for all values of the variables. Trigonometric Ratio is known for the relationship between the measurement of the angles and the length of the sides of the right triangle.

Here we provide a list of all Trigonometry formula for the students. These formulas are helpful for the students in solving problems based on these formulas or any trigonometric application. Along with these, trigonometric identities help us to derive the trigonometric formulas, if they will appear in the examination.

We also provide the basic trigonometric table pdf that gives the relation of all trigonometric functions along with their standard values. These trigonometric formulae are helpful in determining the domain, range, and value of a compound trigonometric function. Students can refer to the formulas provided below or can also download the trigonometric formulas pdf that is provided above.